



NIAC Spring Symposium

Pasadena, CA - March 27-29, 2012



Tuesday, March 27

- 8:25 **Introduction and Welcome** *Jay Falker, NIAC Program Executive*
- 8:40 **NIAC Overview** *Jay Falker, NIAC Program Executive*
- 9:00 **Keynote Address** *Gentry Lee, NASA JPL*
"Innovation and Infusion in a Structured World"
- 10:00 Break**
- 10:20 *Grover Swartzlander, Rochester Institute of Technology*
Steering of Solar Sails Using Optical Lift Force
- 10:45 *John Mankins, Artemis Innovation Management Solutions*
SPS-ALPHA: The First Practical Solar Power Satellite via Arbitrarily Large PHased Array
- 11:10 *Michael Paul, Pennsylvania State University*
Non-Radioisotope Power Systems For Sunless Solar System Exploration Missions
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11:35 Lunch

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- 1:00 *Kurt Hohman, Busek Co. Inc.*
Atmospheric Breathing Electric Thruster for Planetary Exploration
- 1:25 *Steven Howe, Universities Space Research Association*
Economical Radioisotope Power
- 1:50 *Daniel Gregory, Raytheon BBN Technologies*
Space Debris Elimination (SpaDE)
- 2:15 *Bong Wie, Iowa State University*
Optimal Dispersion of Near-Earth Objects
- 2:40 Break**
- 3:00 *Isaac Silvera, Harvard University*
Metallic Hydrogen: A Game Changing Rocket Propellant
- 3:25 *James Gilland, Ohio Aerospace Institute*
The Potential for Ambient Plasma Wave Propulsion
- 3:50 *John Slough, MSNW LLC*
Nuclear Propulsion Through Direct Conversion of Fusion Energy
- 4:15 *Alfonso Tarditi, University of Houston at Clear Lake*
Aneutronic Fusion Spacecraft Architecture
- 4:40 *Robert Werka, NASA Marshall Space Flight Center*
Proposal for a Concept Assessment of a Fission Fragment Rocket Engine (FFRE) Propelled Spacecraft
- 5:05 Adjourn**



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Wednesday, March 28

8:25 **Introduction and Welcome** *Jay Falker, NIAC Program Executive*

8:40 **NIAC Program Plans** *Jay Falker, NIAC Program Executive*

9:00 **Keynote Address** *David Brin, Futures Unlimited*
"Looking Upward - The Most Human Trait"

10:00 Break

10:20 *Scott Ferguson, North Carolina State University*
Enabling All-Access Mobility for Planetary Exploration Vehicles via Transformative Reconfiguration

10:45 *Marco Pavone, Stanford University*
Spacecraft/Rover Hybrids for the Exploration of Small Solar System Bodies

11:10 *Gregory Scott, Naval Research Laboratory*
Low Power Microrobotics Utilizing Biologically Inspired Energy Generation

11:35 Lunch

1:00 *Kendra Short, NASA Jet Propulsion Laboratory*
Printable Spacecraft

1:25 *Robert Staehle, NASA Jet Propulsion Laboratory*
Interplanetary CubeSats: Opening the Solar System to a Broad Community at Lower Cost

1:50 *Paul Stysley, NASA Goddard Space Flight Center*
Laser-Based Optical Trap for Remote Sampling of Interplanetary and Atmospheric Particulate Matter

2:15 *William (Red) Whittaker, Astrobotic Technology Inc.*
Technologies Enabling Exploration of Skylights, Lava Tubes and Caves

2:40 Break

3:00 *Paul Kwiat, University of Illinois at Urbana-Champaign*
Entanglement-assisted Communication System for NASA's Deep-Space Missions: Feasibility Test and Conceptual Design

3:25 *Dmitry Strelakov, NASA Jet Propulsion Laboratory*
Ghost Imaging of Space Objects

3:50 *David Miller, Massachusetts Institute of Technology*
High-Temperature Superconductors as Electromagnetic Deployment and Support Structures in Spacecraft

4:15 *Joe Ritter, University of Hawaii*
Ultra-Light "Photonic Muscle" Space Structures

4:40 *Laurent Sibile, NASA Kennedy Space Center*
In-Space Propulsion Engine Architecture based on Sublimation of Planetary Resources: from Exploration Robots to NEO Mitigation

5:05 Adjourn



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Thursday, March 29

- 8:25 **Introduction and Welcome** *Jay Falker, NIAC Program Executive*
- 8:35 *Sheila Thibeault, NASA Langley Research Center*
Radiation Shielding Materials Containing Hydrogen, Boron, and Nitrogen: Systematic Computational and Experimental Study
- 9:00 *Ram Tripathi, NASA Langley Research Center*
Meeting the Grand Challenge of Protecting Astronaut's Health: Electrostatic Active Space Radiation Shielding for Deep Space Missions
- 9:25 *Shayne Westover, NASA Johnson Space Center*
Radiation Protection and Architecture Utilizing High Temperature Superconducting Magnets
- 9:50 Break**
- 10:10 *Michael Hogue, NASA Kennedy Space Center*
Regolith Derived Heat Shield for a Planetary Body Entry and Descent System with In-Situ Fabrication
- 10:35 *Behrokh Khoshnevis, University of Southern California*
Contour Crafting Simulation Plan for Lunar Settlement Infrastructure Build-Up
- 11:00 *Kevin Duda, The Charles Stark Draper Laboratory*
Variable Vector Countermeasure Suit (V2Suit) for Space Habitation and Exploration
- 11:25 **Phase II Proposal Q and A** *Jay Falker, NIAC Program Executive*
- 11:45 **Symposium Wrap-up and Summary** *Jay Falker, NIAC Program Executive*
- 12:00 Adjourn**



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About NIAC:

The NASA Innovative Advanced Concepts (NIAC), seeks innovative, technically credible advanced concepts that could one day change the possible in aeronautics and space. The development of revolutionary aerospace technologies is critical for our nation to meet its goals to explore and understand the Earth, our solar system, and the universe. NIAC efforts will improve the Nation's leadership in key research areas, enable far-term capabilities, and spawn disruptive innovations that make aeronautics, science, space travel, and exploration more effective, affordable, and sustainable. NIAC is a component of the Space Technology Program within NASA's Office of the Chief Technologist.

Invited Speakers:



Gentry Lee

Gentry Lee is Chief Engineer for the Solar System Exploration Directorate at the Jet Propulsion Laboratory (JPL) in Pasadena, California. In that position he is responsible for the engineering integrity of all the robotic planetary missions managed by JPL for NASA. His major recent work includes the engineering oversight of the Dawn mission to the asteroids Vesta and Ceres, the Juno mission to Jupiter, and the GRAIL mission to the Moon. Previously, he provided guidance and oversight for the engineering aspects of the Phoenix and twin rover missions to Mars, as well as NASA's successful Deep Impact and Stardust missions.

He was Chief Engineer for the Galileo project from 1977-1988 and, after working in a variety of positions on the Viking project from 1968-76, was Director of Science Analysis and Mission Planning during the Viking operations. The historic Viking mission was mankind's first successful landing on another planet. The Galileo mission explored Jupiter with both an atmospheric probe and an orbiter that mapped the major Jovian satellites during a decade of operations.

In addition to his engineering work, he has been an active novelist, television producer, computer game designer, media columnist, lecturer, and, more recently, a television performer/narrator. Between 1989 and 1994 he co-authored four novels, CRADLE, RAMA II, THE GARDEN OF RAMA, and RAMA REVEALED, with revered science fiction grandmaster Arthur C. Clarke. All four books were New York Times bestsellers and were translated into over twenty languages. Since his collaboration with Mr. Clarke, he has written three more successful solo novels, BRIGHT MESSENGERS, DOUBLE FULL MOON NIGHT, and THE TRANQUILITY WARS.

From 1976 until 1981 he was the late Carl Sagan's partner in the creation, design, development, and implementation of COSMOS, the highly successful science documentary series for

television that won several Emmys and the prestigious Peabody Award. In July 2009, he was the featured performer/narrator in "Are We Alone?" a two hour Discovery Channel documentary about life in the solar system.

He received the NASA Medal for Exceptional Scientific Achievement in 1976 and the Distinguished Service Medal (NASA's highest award) in 2005. In October 2006 he received the prestigious Harold Masursky Award from the American Astronomical Society's Division of Planetary Sciences for his career contributions to planetary exploration.

He received a B. A., Summa Cum Laude, from the University of Texas at Austin in 1963 and an M. S. from the Massachusetts Institute of Technology in 1964. Gentry Lee (69) has eight sons, Cooper (35), Austin (31), Robert (25), Patrick (24), Michael (22), Travis (20), Hunter (17), and Francesco (born Mar 15, 2009).



David Brin

David Brin is a scientist, speaker, technical consultant and world-known author. His novels have been New York Times Bestsellers, winning multiple Hugo, Nebula and other awards. At least a dozen have been translated into more than twenty languages. His 1989 ecological thriller, *Earth*, foreshadowed global warming, cyber warfare and near-future trends such as the World Wide Web*. A 1998 movie, directed by Kevin Costner, was loosely based on *The Postman*. He serves on advisory

committees dealing with subjects as diverse as national defense and homeland security, astronomy and space exploration, SETI and nanotechnology, future/prediction and philanthropy. His non-fiction book -- *The Transparent Society: Will Technology Make Us Choose Between Freedom and Privacy?* -- deals with secrecy in the modern world. It won the Freedom of Speech Prize from the American Library Association. As a public "scientist/futurist" David appears frequently on TV, including "The Universe" and the History Channel's best-watched show "Life After People." He also was a regular cast member on "The ArciTECHS."

His scientific work covers an eclectic range of topics, from astronautics, astronomy, and optics to alternative dispute resolution and the role of neoteny in human evolution. His Ph.D in Physics from UCSD - the University of California at San Diego (the lab of nobelist Hannes Alfvén) - followed a masters in optics and an undergraduate degree in astrophysics from Caltech. He was a postdoctoral fellow at the California Space Institute and the Jet Propulsion Laboratory. His patents directly confront some of the faults of old-fashioned screen-based interaction, aiming to improve the way human beings converse online. Additional details about his accomplishments can be found on his website: <http://www.davidbrin.com/biography.htm>.



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Local Restaurants:

PRICES REPRESENTS ONE ENTRÉE & DRINK {KEY: \$=UP TO \$10, \$\$=UP TO \$20, \$\$\$=UP TO \$30,
W= WITHIN WALKING DISTANCE OF THE WESTIN PASADENA }

OLD PASADENA DISTRICT

SOMETHING FOR EVERYONE IN THIS 20-BLOCK NEIGHBORHOOD AS YOU'LL SEE WHEN YOU STROLL DOWN HISTORIC STREETS AND ALLEYWAYS.

AKBAR CUISINE OF INDIA (INDIAN) 44 N. FAIR OAKS AVE. 626-577-9916 (\$)
BARCELONA (LATIN) 46 E. COLORADO BLVD. 626-304-1000 (\$\$)
BARNEY'S BEANERY (SPORTS BAR) 99 E. COLORADO BLVD. 626-405-9777 (\$)
BRENART CAFÉ (AMERICAN-EUROPEAN) 53 E. UNION ST. 626-796-7460 (\$\$)
BUCA DI BEPPO (ITALIAN) 80 W. GREEN ST. 626-792-7272 (\$\$)
CAFÉ BIZOU (FRENCH) 91 N. RAYMOND AVE. 26-792-9923 (\$\$)
CAFÉ SANTORINI (MEDITERRANEAN) 64 & 70 W. UNION 626-564-4204 (\$\$)
CENTRAL PARK CAFÉ (AMERICAN) 219 S. FAIR OAKS AVE. 626-449-4499 (\$)
CHANDRA THAI (INDIAN) 400 S. ARROYO PKWY. 626-577-6599 (\$\$)
CHEESECAKE FACTORY (AMERICAN) 2 W. COLORADO BLVD. 626-584-6000 (\$\$)
CITY THAI (ASIAN CUISINE) 48 S. FAIR OAKS AVE. 626-577-1500 (\$\$)
DENA HOUSE (AMERICAN) 42 S. DE LACEY ST. 626-405-9114 (\$)
EDEN GARDEN BAR & GRILL (AMERICAN) 175 E. HOLLY ST. 626-440-1421 (\$\$)
GELATO DI ROMA (PIZZA & ICE CREAM) 124 E. COLORADO BLVD. 626-844-2922 (\$)
GORDON BIERSCHE (MICRO-BREWERY) 41 HUGUS ALLEY 626-449-0052 (\$\$)
GREEN STREET TAVERN (CALIFORNIA/EUROPEAN) 69 W. GREEN ST. 626-226-9961 (\$\$)
GYU-KAKU (JAPANESE BBQ) 70 W. GREEN ST. 626-405-4842 (\$\$)
IL FORNAIO (ITALIAN/BAKERY) 24 W. UNION ST. 626-683-9797 (\$\$)
JJ's STEAK HOUSE (AMERICAN) 88 W. COLORADO BLVD. 626-844-8889 (\$\$\$)
LA GRANDE ORANGE CAFÉ (AMERICAN) 260 S. RAYMOND AVE. 626-356-4444 (\$\$)
LA LUNA NEGRA (LATIN) 44 W. GREEN ST. 626-844-4331 (\$\$\$)
LE PAIN QUOTIDIEN (FRENCH) 88 W. COLORADO BLVD. 626-396-0956 (\$\$)
LOUISE'S TRATTORIA (ITALIAN) 2 E. COLORADO BLVD. 626-568-3030 (\$\$)
MALAGUETA (BRAZILIAN/MEDITERRANEAN) 43 E. COLORADO BLVD. 626-564-8696 (\$\$)
MI PIACE' (ITALIAN) 23 E. COLORADO BLVD. 626-795-3131 (\$\$)
MOJITOS (CUBAN) 69 N. RAYMOND AVE. 626-796-2520 (\$\$)
NEOMEZE (BAR & LOUNGE) 20 E. COLORADO BLVD. 626-793-3010 (\$\$)
RED, WHITE & BLUEZZ (CONTEMPORARY AMERICAN) 70 S. RAYMOND AVE. 626-792-4441 (\$\$) (W)
RICE ZEN (ASIAN) 49 E. COLORADO BLVD. 626-585-8822 (\$)
RUSSELL'S (AMERICAN) 30 N. FAIR OAKS AVE. 626-578-1404 (\$)
SUSHI ROKU (JAPANESE) 33 MILLER ALLEY 626-683-3000 (\$\$\$)
THE CREPE VINE BISTRO & WINE BAR (FRENCH) 36 W. COLORADO BLVD. 626-796-7250 (\$\$)
THE MELTING POT (AMERICAN) 88 W. COLORADO BLVD. 626-792-1941 (\$\$\$)
TRE VENEZIE (ITALIAN) 119 W. GREEN ST. 626-795-4455 (\$\$\$)
TWIN PALMS (CALIFORNIA COASTAL) 101 W. GREEN ST. 626-577-2567 (\$\$)
VILLA SORISSO (ITALIAN) 168 W. COLORADO BLVD. 626-793-8008 (\$\$)
VIVE DINING & LOUNGE (LATIN-ASIAN) 61 N. RAYMOND AVE. 626-583-8483 (\$\$\$)
YUJEAN KANGS (GOURMET CHINESE) 67 N. RAYMOND AVE. 626-585-0855 (\$\$\$)

PASEO COLORADO

PASADENA'S THREE-BLOCK, OPEN-AIR VILLAGE IS LOCATED DIRECTLY ACROSS FROM THE PASADENA CONVENTION CENTER. FEATURING 65 STREET-FRONT RETAIL SHOPS, INCLUDING COACH, J. JILL, ANN TAYLOR LOFT, TOMMY BAHAMA, AND OTHERS.

CALIFORNIA CRISP (CALIFORNIA) 626-396-9992 (\$) (W)
CAMILLE'S SIDEWALK CAFÉ (AMERICAN) 626-440-1212 (\$) (W)
CHINESE GOURMET EXPRESS (FAST FOOD/CHINESE) 626-568-3559 (\$) (W)

COLD STONE CREAMERY 626-440-0420 (\$) (W)
GELSON'S THE SUPER MARKET (DELI) 626-535-0190 (\$) (W)
ISLAND'S FINE BURGERS & DRINKS (AMERICAN) 626-304-9050 (\$) (W)
LEAFOREVER TEAHOUSE 626-796-0198 (\$) (W)
PASEO CANTINA (MEXICAN) 626-683-3100 (\$\$) (W)
P.F. CHANG'S CHINA BISTRO (CHINESE) 626-356-9760 (\$) (W)
PORTO ALEGRE BRAZILIAN BBQ (LATIN) 626-795-0555 (\$\$) (W)
RUBIO'S BAJA GRILL (FAST FOOD/MEXICAN) 626-535-9383 (\$) (W)
STARBUCKS COFFEE 626-564-0914 (\$) (W)
TOKYO WAKO (JAPANESE) 626-440-0670 (\$\$) (W)
YARD HOUSE RESTAURANT (MICRO-BREWERY) 626-577-9273 (\$\$) (W)

LAKE AVENUE DISTRICT

SOUTH LAKE AVENUE IS ONE OF THE TRULY "IN" PLACES TO SHOP IN SOUTHERN CALIFORNIA. HIGH-END STORES AND TWO ARCADES BRING A MYRIAD OF UPSCALE GOODS AND SERVICES.

BAJA FRESH GRILL (MEXICAN) 899 E. DEL MAR BLVD. 626-792-0446 (\$)
CELESTINO RISTORANTE (ITALIAN) 141 S. LAKE AVE. 626-795-4006 (\$\$\$)
CROCODILE CAFÉ (CALIFORNIA) 140 S. LAKE AVE. 626-449-9900 (\$\$)
GREEN STREET RESTAURANT (AMERICAN) 146 S. SHOPPERS LN. 626-577-7170 (\$\$)
MAGNOLIA (URBAN LOUNGE) 492 S. LAKE AVE. 626-584-1126 (\$\$)
PIE N' BURGER (AMERICAN) 913 E. CALIFORNIA BLVD. 626-793-4300 (\$)
RADHIKAS CUISINE OF INDIA (INDIAN) 140 SHOPPERS LN. 626-744-0994 (\$\$)
SMITTY'S GRILL (AMERICAN) 110 S. LAKE AVE. 626-792-9999 (\$\$\$)
TONY ROMAS (AMERICAN) 246 S. LAKE AVE. 626-405-0612 (\$\$)

PLAYHOUSE DISTRICT

THE PLAYHOUSE DISTRICT IS IN THE HEART OF PASADENA ANCHORED BY THE PASADENA PLAYHOUSE, THE STATE THEATRE OF CALIFORNIA; VROMAN'S BOOKSTORE; TARGET DEPARTMENT STORE AND CALIFORNIA SCHOOL OF CULINARY ARTS.

561 RESTAURANT (CALIFORNIA) 561 E. GREEN ST. 626-405-1561 (\$\$) (W)
BISTRO 45 (FRENCH) 45 S. MENTOR AVE. 626-795-2478 (\$\$\$)
CA SCHOOL OF CULINARY ARTS CAFÉ 561 E. GREEN ST. 626-683-7319 (\$) (W)
EL PORTAL (MEXICAN) 695 E. GREEN ST. 626-795-8553 (\$\$)
JAPON BISTRO (JAPANESE) 927 E. COLORADO BLVD. 626-744-1751 (\$\$\$)
MADELEINES (FRENCH RESTAURANT) 1030 E. GREEN ST. 626-440-7087 (\$\$\$)
MAISON AKIRA (FRENCH-JAPANESE) 713 E. GREEN ST. 626-796-9501 (\$\$\$)
SUSHI OF NAPLES (JAPANESE) 735 E. GREEN ST. 626-578-1123 (\$\$)
TARANTINO'S (ITALIAN) 784 E. GREEN ST. 626-796-7836 (\$)

OTHER AREAS

ARROYO CHOP HOUSE (STEAKHOUSE) 536 S. ARROYO PKWY. 626-577-7463 (\$\$\$)
BARN BURNER TEXAS BARBEQUE 1000 S. FAIR OAKS AVE. 626-403-7427 (\$)
BECKHAM GRILL (ENGLISH CONTINENTAL) 77 W. WALNUT ST. 626-796-3399 (\$\$)
BIG BEN'S DELI CAFÉ (FAST FOOD/DELI) 199 S. LOS ROBLES AVE. 626-793-0871 (\$) (W)
CAFÉ CORDOVA (FAST FOOD/DELI) 375 E. CORDOVA ST. 626-795-5711 (\$) (W)
CALIFORNIA PIZZA KITCHEN (PIZZA & PASTA) 99 N. LOS ROBLES AVE. 626-585-9020 (\$\$) (W)
EL CHOLO (MEXICAN) 958 S. FAIR OAKS AVE. 626-441-4353 (\$\$)
HOUSTON'S (STEAKHOUSE) 320 S. ARROYO PKWY. 626-577-6001 (\$\$\$)
MARGARITA JONES (MEXICAN) 541 S. ARROYO PKWY. 626-744-1828 (\$)
MARSTON'S RESTAURANT (AMERICAN) 151 E. WALNUT ST. 626-796-2459 (\$\$)
MCCORMICK & SCHMICK'S (SEAFOOD) 111 N. LOS ROBLES AVE. 626-405-0064 (\$\$) (W)
PARKWAY GRILL (CALIFORNIA) 510 S. ARROYO PKWY. 626-795-1001 (\$\$\$)
RAYMOND RESTAURANT (AMERICAN) 1250 S. FAIR OAKS AVE. 626-441-3136 (\$\$\$)
RUTH'S CHRIS (STEAKHOUSE) 369 E. COLORADO BLVD. 626-583-8122 (\$\$\$) (W)
SALADANG (THAI) 363 S. FAIR OAKS AVE. 626-793-8123 (\$\$)
SALADANG SONG (THAI) 363 S. FAIR OAKS AVE. 626-793-5200 (\$\$)
TIFFANY'S COFFEE (FAST FOOD/DELI) 263 E. COLORADO BLVD. 626-795-8526 (\$) (W)